



Dynamic linkages among oil price, gold price, exchange rate, and stock market in India



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ABSTRACT

Governments impose taxes and levies to manage the effect of gold and crude oil imports on the exchange rate. These in return have relations with the economy of the country, best reflected in the stock market index. This study aims to explore the relation between global prices of gold, crude oil, the USD–INR exchange rate, and the stock market in India. The dynamic contemporaneous linkages have been analyzed using DCC-GARCH (standard, exponential and threshold) models and the lead lag linkages have been examined using symmetric and asymmetric Non Linear Causality tests. Empirical analyses indicate fall in gold prices and crude oil prices cause fall in the value of the Indian Rupee and the benchmark stock index i.e. Sensex. The findings of this study also support the emergence of gold as an investment asset class among the investors. More importantly, this study highlights the need for dynamic policy making in India to contain exchange rate fluctuations and stock market volatility using gold price and oil price as instruments.

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1. Introduction

Oil price has always been considered as a leading indicator of exchange rate movements in the world economy (Amano and van Norden, 1998). This is because international transactions of oil are done largely in US Dollars and hence higher demand for oil leads to local currency depreciation. Moreover, fluctuating international prices of oil due to variations in its demand and supply lead to fluctuations of exchange rate of an oil importing economy. Especially for oil importing countries like India, fluctuations in international oil prices lead to rupee depreciation and at the same time increase in inflation rate (Raj et al., 2008).

Recent co-movements in gold and oil prices have increased interest level of researchers in examining linkages between gold and oil as their price movements have important implications for an economy and the financial markets (Reboredo, 2013). The reason is that in an inflationary economy investors increase their

holdings of gold because it acts as hedge against inflation. Melvin and Sultan (1990), who observed that oil-exporting countries, in particular, include gold in their international reserve portfolios; when oil prices and revenues rise, they increase their investment in gold in order to maintain its share in their diversified portfolios and this increased demand for gold leads to an increase in its price that mirrors the increase in the oil price. The relation between oil price and gold price is also explained through import channel as most of the oil-importing countries pay for their supplies of oil in gold (Tiwari and Sahadudheen, 2015).

There is one more stream of literature where researchers' find that gold price and oil price are linked through the US dollar exchange rate. When the US dollar depreciates against other major currencies, investors may choose to use gold as a safe haven (Capie et al., 2005; Joy, 2011), thus pushing up gold prices (Reboredo, 2012). All these studies support the argument that gold and oil prices follow certain patterns which ultimately impact exchange rate. Therefore, examining linkages between gold price, oil price and the exchange rate of an oil importing economy could be very helpful to investors and policy makers.

Of late, commodities are emerging as investment asset classes and they are increasingly becoming part of asset portfolio

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allocations for investors and portfolio managers. It has become more evident that commodity (particularly oil and gold) traders concurrently eye both the commodities and stock market movements to determine the directions of commodities prices and stock indices (Choi and Hammoudeh, 2010). Investment in stock markets provides an alternative to commodities, since the presence of the stock markets in the economy provides a mechanism for substitution between stock and commodity classes. Since gold and other precious metals are considered to be safe assets, investors shift over to those commodities investments when economy of the country is not doing well and vice-versa.

Plethora of prior research has happened on some individual pairs of the variables under consideration using linear models. Such models might no longer be appropriate due to the increasing tendency of commodity prices to behave like financial prices. The post financial crisis period (2009–present) has seen several large swings in the prices of gold and crude oil. Emergence of ISIS and the Arab Spring led to oil price shocks, whereas price of gold surged due to it being considered a safe haven. These sharp movements might have resulted in dynamic changes in the prices of commodities and caused unexpected responses in the behavior of market participants across commodities, currencies and stock markets (Bildirici and Turkmen, 2015).

India being the fourth largest importer of oil¹ and the largest consumer of gold,² fluctuations in international prices of oil and gold could have significant impact on currency rate, stock market, and on other economic activities. Oil accounts for 29% of India's total energy consumption and there seems to be no possibility of scaling down on dependency in future. It is also noticed that when stock market in India is on a bull-run, foreign portfolio investment flow increases leading to an appreciation in domestic currency.

Therefore, it is very important that investors, portfolio managers, and policy makers do understand the dynamic linkages among oil price, gold price, exchange rate, and stock market. This paper aims to study the dynamic contemporaneous linkages among the above four variables by using the DCC-GARCH framework and non linear non causality tests to study the lead lag relationship amongst the four variables under examination. This paper is organized as follows. The next section presents briefly reviews the existing literature in related areas of research. Section 3 outlines the data and empirical methodologies used. Section 4 presents the results and their discussion and Section 5 concludes.

2. Literature review

Relationships between oil price and exchange rate, oil price and gold, and exchange rate and the economy (stock market) have been researched extensively in literature. Amano and Van Norden (1998), Camarero and Tamarit (2002), Cologni and Manera (2008), Rautava (2004) and Sari et al. (2010) found a long-term correlation between oil prices and the exchange rate. Dooley et al. (1995) and Nikos (2006) indicated that exchange rate fluctuations reflect the situations of individual countries.

So far as gold price and exchange rate relationship is concerned, it has received increasing attention by both academia and industry. Sjaastad and Scacciavillani (1996) and Sjaastad (2008) studied the relationship between gold price and euro; gold price and US \$ exchange rate respectively, and argued that in the 1980s, gold price was dominated by euros but in the 1990s, US \$ gradually replaced the euro. Tully and Lucey (2007) developed an APGARCH

model to investigate the shocks of macro economy to gold spot and futures markets and found that US \$ was a major macro-economic variable to influence the gold price volatility.

On the price dynamics in crude oil market and gold market, an array of research has been reviewed and the findings suggest strong relationships (Ye, 2007; Zhang et al., 2007). Cashin et al. (1999), used the data of seven commodities and found a significant correlation between oil and gold. Hammoudeh and Yuan (2008), examined the volatility behavior of three metals: gold, silver and copper and found that oil shocks had calming effects on precious metals excluding copper. Lescaoux (2009), investigated the correlations among crude oil and precious metals and reported that they tended to move together. Soytas et al. (2009) investigated the long run and short run impacts of gold and silver prices on oil price but found no causal relationship amongst the variables. Sari et al. (2010) studied the impact of oil price shocks over gold, silver, platinum and palladium and observed a weak asymmetric relationship among gold and oil prices.

Narayan et al. (2010) examined gold and oil spot and future markets. They concluded that gold is a hedge against inflation and oil and gold markets can be used to predict each other. Zhang and Wei (2010) tested the causality between crude oil and gold market over a period of eight years and observed a linkage between crude oil price and gold price volatility. Šimáková (2011) observed a long term relationship between oil and gold prices.

Moreover, Lee and Lin (2012) examine the nonlinear dynamic relationship among USD/Yen, gold futures, VIX, crude oil and several stock indexes. According to their findings, the role of gold is determined according to crude oil price. From this aspect; as the price of crude oil is low, gold exhibits a hedging function; when price of oil is high, gold is both a hedge and safe haven for developing countries. Chang et al. (2013) investigated the correlation among oil prices, gold prices and exchange and conclude that the variables are considerably independent. Naifar and Al Dohaiman (2013) tested the nonlinear structure of oil prices by using several econometric methods and stressed the explanatory power of linear models.

However, the dynamic linkages among any three macro-economic variables mentioned above, neither mentioned in economic theory nor studied much in empirical literature. Sari et al. (2010) examined the co-movements and information transmission among the spot prices of four precious metals, oil price, and the US dollar/euro exchange rate. They found evidence of a weak long-run equilibrium relationship but strong feedbacks in the short-run. Jain and Ghosh (2013) studied long-run relationship and causality among global oil prices, precious metals prices, and INR/USD exchange rate. They found a long run relationship among variables when exchange rate and gold price remain as dependent variables. Their Granger causality tests indicated that exchange rate causes precious metal prices and oil price in India.

After a comprehensive review of existing literature a gap was found to exist in the exploration of interaction of commodity markets, stock market and exchange rate. As the exchange rate is an important macroeconomic variable, having linkages to inflationary tendencies in an oil importing country like India, research on its interactions would provide insights for its management by the central bank. This study examines the dynamic time varying relationship among oil price, gold price, exchange rate, and stock market using DCC-GARCH framework. This study also analyzes lead-lag interaction among all the four macroeconomic variables using non-linear causality test. Evidence of non-linear causal relations has been established by Fernandez (2014) between commodity prices and price indices.

¹ OPEC Annual Statistical Bulletin, <http://www.opec.org/library/Annual%20Statistical%20Bulletin/interactive/current/FileZ/Main.htm>.

² Gold Demand Trends 2014, World Gold Council. www.gold.org/download/file/3691/GDT_Q4_2014.pdf.

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